

# Air Force Materiel Command

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*Providing World-Class Combat Support*



## Institute of Systems Engineering

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**U.S. AIR FORCE**

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*Integrity - Service - Excellence*



# Agenda



- **Background**
- **Institute of Systems Engineering Forum**
  - Top SE Gaps/Shortfalls Identified
  - Top SE Recommendations Identified
- **Institute of Systems Engineering**
  - Roles/Challenges
  - Proposed Models
  - Analysis
- **Summary**

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# SECAF Guidance



- “Create an Institute for Systems Engineering”

- Develop Plan to strengthen Air Force’s systems engineering capabilities

- Education, training, consultation, advocacy of Systems Engineering process



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# Status



- Apr 02 – SecAF directs the creation of an Institute for Systems Engineering
- Jul 02 – AF Chief Scientist visits WPAFB and works with AFIT to restructure its Master of Science program in SE and create SE Certification program
- Aug 02 – ISE Forum Conducted
- Aug 02 – AF Chief Scientist conducted first Academic Advisory Board Meeting @ WPAFB
- Sep 02 – Results of ISE Forum and ISE recommendations coordinated with Forum Participants and SAF/AQRE
- Oct 02 – Forum Results, Revitalization, and SE Improvement efforts of AFMC & SAF/AQRE briefed at AFMC Engineering Council
- Oct 02 – AFIT initiates first classes in “revised” SE MS and Certificate Programs
  - Over 30 engineers enrolled in SE Certificate Program
- Oct/Nov 02 – AFMC/CC to be briefed on ISE and Forum Results/Recommendations

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# Introduction



- Approach
  - AFMC/EN conducted an Institute of Systems Engineering Forum on 28-29 Aug 2002
    - Identified key gaps and shortfalls in the defense industry systems engineering community
    - Identified top recommendations to address the gaps and shortfalls
    - Discussed possible roles for an Institute and potential models to meet these gaps
  - Maintaining a high level of collaboration with the Forum participants
    - Mapped recommendations to determine the role for an Institute of System Engineering
    - Develop roadmap to implement the Institute of Systems Engineering
      - Cost, Schedule, Resources, etc

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# Forum Participants



- 44 Recognized Systems Engineering Experts
  - AF
    - AF/ST, SAF/AQRE, AFMC/CD, AFMC/EN, ASC/EN, ESC/EN, SMC/AXE, AAC/EN, WR-ALC, MDA/SEB, AFSPC/DRX, Aerospace Corp, MITRE
  - Other Services
    - OSD, Navy, Army, Marine Corps
  - Academia
    - AFIT, USC, George Mason U, Stevens Inst., Johns Hopkins U, Naval Post Graduate School
  - Industry
    - Northrop-Grumman, Boeing, General Electric, Lockheed-Martin
  - Professional
    - International Council On Systems Engineering (INCOSE), National Defense Industrial Association (NDIA), etc

These are the Top System Engineering Experts from across the nation

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# Top SE Gaps/Shortfalls Identified

## Forum Consensus

The Systems Engineering Process is not broken,  
The Uniform Application of SE Principles is Broken

- No senior level voice or organizational structure for SE across AF, other services or OSD
  - No drive to enforce a disciplined SE process
  - Does not drive resource allocation
  - Poorly defined responsibility, authority and accountability
- Systems Engineering Not Part of Mainstream Acquisition
  - No policy tasking the Program Managers to integrate Systems Engineering into their programs
  - Not part of the Program Management Plan (PMP)

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# Top SE Gaps/Shortfalls Identified



- No clear, common and consistent understanding of the Systems Engineering Process or the role of Systems Engineers
  - Inconsistency in perceived value/appreciation/implementation and/or authority of Systems Engineering across services and programs.
    - Perception that systems engineering responsibility has been delegated to Industry
- Systems Engineering lacks a set of comprehensive, common and consistent tools, guidance and standards.
  - No common sense of process

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# Top SE Gaps/Shortfalls Identified



- There is a lack of trained and experienced military and civilian Systems Engineers across the public and private sectors
  - No or few incentives for Systems Engineers
  - SE cannot be recruited at entry level
- There is a strong need to be able to create and maintain the technical currency of Systems Engineers
  - Disconnect between education and practice
  - Adequacy of SE skills (knowledge, etc.) across DoD

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# Top SE Recommendations Identified



- Establish Systems Engineering enabling organizations with the responsibility, authority and adequate resources, situated at a suitable level within the AF, other services and OSD
  - SE Enabling Organization shall be the senior Systems Engineering voice at key decision-making reviews.
  - For example, SAF/EN level organization at HQ USAF
- Institutionalize Systems Engineering in Program Management
  - Embed Key Systems Engineering features in the Program Management Plan (PMP)
  - Incorporate SE metrics into all DABs, Program Reviews, etc.

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# Top SE Recommendations Identified



- Ensure stakeholders understand the value/importance of applying disciplined System Engineering throughout the life cycle
  - Stakeholders include Acquisition/Sustainment and Science and Technology Functionals, plus Operators and Maintainers
  - Include System Engineering and System Engineering management processes
- Improve Systems Engineering Collaboration
  - Government/industry/academia/professional societies SE collaboration essential
  - For the Air Force
    - Work with INCOSE to add AF representative to corporate board

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# Top SE Recommendations Identified



- Improve Systems Engineering Tools Availability
  - Establish a catalogue of tools showing appropriate use, value, data portability, interoperability, etc.
  - Make them available to the SE community
- Review, revise, create as required and enforce existing policies/instructions/etc.
  - Energize the development of a Joint Systems Engineering Guide
    - Utilize joint service specification guides as model

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# Top SE Recommendations Identified



- Address Systems Engineering Workforce Issues
  - Identify requirements for System Engineering positions for the AF, other services and OSD
  - Establish a System Engineering career track
  - Allow recruitment of future SE with sufficient lead time to train and educate prior to existing SE group departing
- Address Systems Engineering Education and Training
  - Make education and training more available
  - Increased tuition support in high cost areas for SE education
  - Integrate current SE best practices (all sources) into available academic training programs.
  - Drive core SE intellectual consistency at all disciplines involved in program execution

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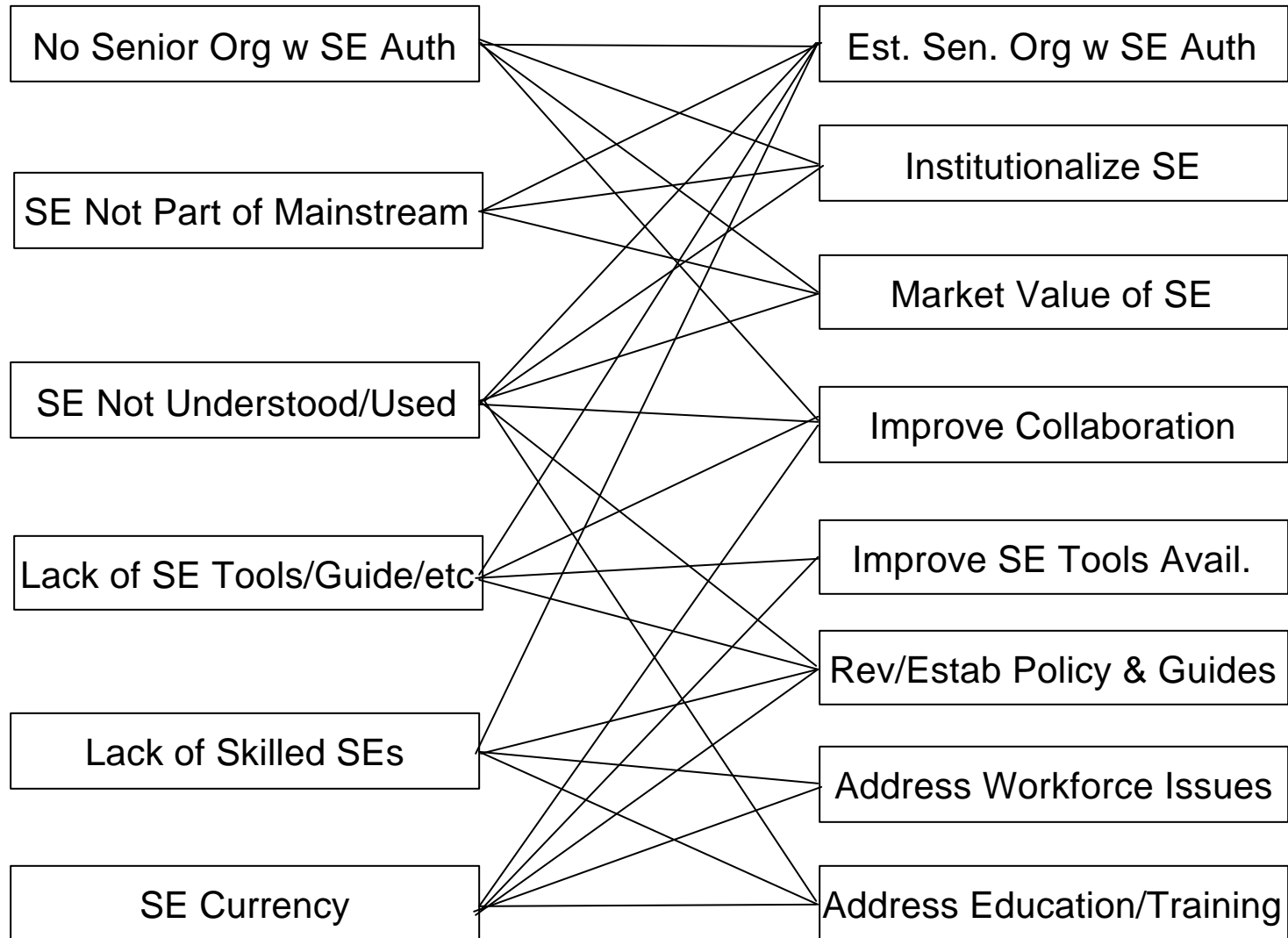
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# Issues/Recommendations Map



- Background
- ISE Forum
- Forum Gaps
- Forum Rec.'s
- ISE
- Roles
- Models
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# ISE Roles



- Separate from the senior level SE enabling organization
  - Has its own corporate board and director
- Roles could include
  - Education/Training/Awareness
  - Consulting
  - Advocacy
  - Collaboration

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# Education/Training/Awareness Role



- Provide collaborative and leadership role with general Systems Engineering education
  - Utilize available sources of academia, industry, professional organizations
  - Provide a forum to shape the academic curriculum for SE
- Work with sources to provide the application training with the services specifically tailored to service needs throughout the life cycle
  - IL, EN, FM, TE, etc., responsible for curriculum specialties
- Available to organizations in many locations
- Provide Mentorship

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# Consultation Role



- Become a nationally recognized SE Information/Tools Portal
- Capture and make available current SE knowledge that resides in a given agency
- Conduct Studies & Analysis including:
  - Conops for Systems of Systems
  - Conceptual Studies/Research
  - Systems Engineering Analysis of Programs
- Conduct independent appraisals/certifications
  - CMMI<sup>SM</sup>, for example
- Provide Advisory Boards
- Provide recommendations for work force development

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# Advocacy Role



- Develop/recommend SE Policy
- Identify/catalogue/Develop SE Standards
- Document/promulgate Case Studies
- Evolve Core SE Processes
- Review and report periodically on the health of SE

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# Collaboration Role



- Provide means for collaboration on:
  - Best Practices
  - Core Processes
  - Encouraging the Study of Engineering (Scholarships, Internships, etc.)
- Collaborative partners include:
  - Air Force, Navy, Army, Marine Corps, OSD
    - Users/MAJCOMs
  - Industry
  - Professional Organizations such as INCOSE/NDIA
  - Academia

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# Roles Map



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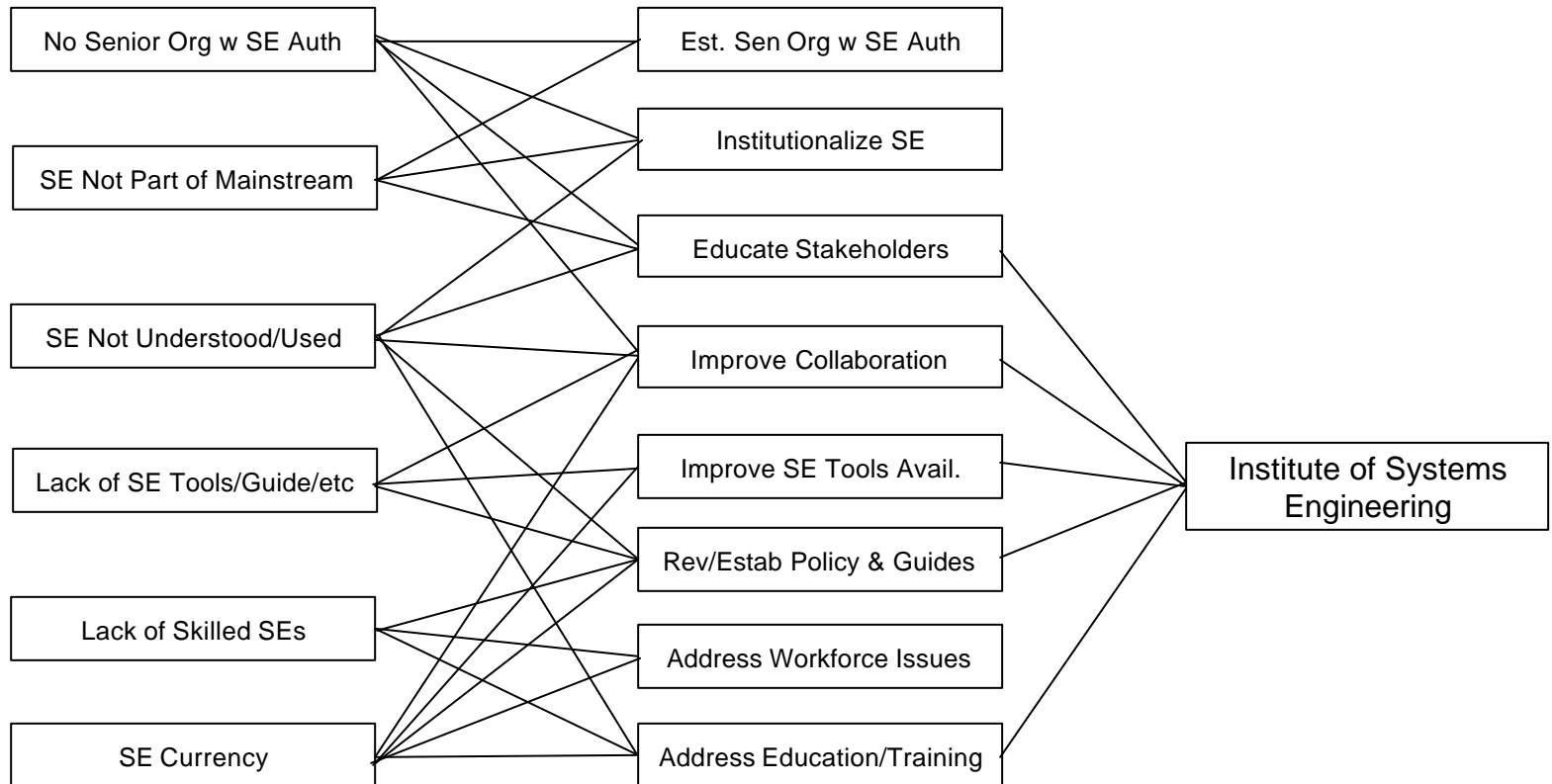
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Issues

Recommendations

Implementing  
Organization



# Summary



- The top SE experts from across the nation have identified a number of Gaps/Shortfalls and Recommendations associated with Systems Engineering
- Establishing Senior Level organizations with SE authority and resources is critical
- An Institute for Systems Engineering can play an important role in improving Systems Engineering across the Department of Defense
  - Needs to have a national scope

## Forum Consensus

The Systems Engineering Process is not broken,  
The Uniform Application of SE Principles is Broken

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